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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/531,070
Filing Date: February 21, 2006
Appellant(s): PATEL ET AL.

Andrew M. Lawrence
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 10/29/2010 appealing from the Office action mailed 10/27/2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 1-3 and 6-24.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

EP 1 178 546	Aziz et al.	2-2002
WO 01/62869	Towns et al.	8-2001

US 2001/0028962	Hirai	10-2001
US 2001/0055454	Roach et al.	12-2001

Lee et al. "Improvement of EL efficiency in polymer light-emitting diodes by heat treatments" Synthetic Metals 117 (2001) 249-251.

Lee et al. "The Effect of Different Heat Treatments on the Luminescence Efficiency of Polymer Light-Emitting Diodes" Advanced Materials, 12, no. 21 (2000), pp. 801-804.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 6-9, 12 and 14-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aziz et al. (EP 1 178 546; hereinafter "Aziz") in view of Lee et al. ("Improvement of EL efficiency in polymer light-emitting diodes by heat treatments"; hereinafter "Lee 1") and/or Lee et al. (The Effect of Different Heat Treatments on the Luminescence Efficiency on the Luminescence Efficiency of Polymer Light-Emitting Diodes"; hereinafter "Lee 2").

Aziz discloses a method of making an organic light emitting device (abstract), comprising of a light emission region formed between an anode (i.e., a first electrode capable of injecting or accepting charge carriers of a first type) and a cathode (i.e., a second electrode capable of injecting or accepting charge carriers of a second type) [0007]. The light emitting region can comprise of an organic light emitting material such as a polyfluorene [0026]. A heat treatment can be carried out after formation of the second electrode at a temperature below the glass transition temperature [0085].

Aziz does not explicitly teach heating the polyfluorene before forming the second electrode. Aziz does teach that the layers of the light emission region can be formed by spin coating [0075]. Accordingly, Lee 1 teaches that it was well known to have baked a spin coated light emitting film prior to the formation of the second electrode at a temperature below glass transition temperature (paragraph bridging pg. 249-250). Lee 2 teaches that baking of the light emitting film prior to formation of the second electrode at a temperature below glass transition temperature is to completely remove the residual solvent (paragraph bridging the two columns of pg. 801). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have heated the polyfluorene film of Aziz immediately after spin coating and prior

to the formation of the second electrode with a reasonable expectation of success. One would have been motivated to do so in order to have prevented any deterioration of the device due to residual solvent.

Claims 19-21: Aziz teaches that the light emitting region can comprise of an organic light emitting material such as a polyfluorene [0026].

Claims 6,17-18,22-24: The method forms an electroluminescent device.

Claim 7: Aziz teaches that the first electrode can be an anode and that the second electrode can be a cathode [0025].

Claims 8-9: Aziz teaches that the cathode can have a work function between 2.5 eV and 4.0 eV and that it can comprise calcium [0077].

Claim 12: Aziz teaches that a hole transport layer (i.e., a layer of conductive organic material) can be formed between the anode and the polyfluorene [0029],[0071].

Claims 14-15: Aziz teaches that the light emitting portion can be a mixed layer of a hole transport material and an electron transport material [0035]-[0036].

Claim 16: Aziz teaches that the light emission region can emit light colors of red, green, or blue [0045].

Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aziz '546 in view of Lee 1 and Lee 2 as applied to claim 1 above, and further in view of Towns et al (WO 01/62869; hereinafter "Towns").

Aziz teaches the use of a polyfluorene material in the light emission region, but does not explicitly teach that the polyfluorene comprises of the structure as claimed in claims 2 and 3. However, Towns teaches that an electroluminescent material comprising of the structure as claimed can be used in the light emitting layer (pg. 18). The polymer can provide solubility, processability, and good efficiency and lifetime in the device (last paragraph of pg. 5). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have used the electroluminescent polymer material of Towns as the particular polyfluorene of Aziz with a reasonable expectation of success. One would have been motivated to do so in order to have provided the OLED device with good efficiency and lifetime.

Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aziz '546 in view of Lee 1 and Lee 2 as applied to claim 1 above, and further in view of Hirai (U.S. Publication No. 2001/0028962; hereinafter "Hirai").

Aziz does not explicitly teach forming a metal fluoride dielectric layer between the polyfluorene and the cathode. However, Hirai teaches that it was well known in the OLED art (abstract) to have formed an electron injecting layer comprising of an insulating thin film between the light emitting layer and the negative electrode. The insulating film can be lithium fluoride (i.e., a metal fluoride) [0046]. The negative electrode of Hirai [0034] can be made of similar materials as the cathode of Aziz [0077]. Because Hirai teaches that such structures were well known in the OLED art, it would have been obvious to one of ordinary skill in the art at the time of invention to have formed an electron injecting layer comprising of an insulating thin film between the light emission region and the cathode of Aziz with a reasonable expectation of success. The selection of something based on its known suitability for its intended use has been held to support a prima facie case of obviousness (MPEP 2144.07).

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aziz '546 in view of Lee 1 and Lee 2 as applied to claim 12 above, and further in view of Roach et al. (U.S. Publication No. 2001/0055454; hereinafter "Roach").

Aziz does not explicitly teach that the hole transport material can be PEDT/PSS. However, Roach teaches that it was well known in the OLED art to have used PEDOT/PSS as a hole transport material [0039]. Because Roach teaches that such a material was operable as a hole transport material, it would have been obvious to one of ordinary skill in the art at the time of invention to have used PEDOT/PSS as the particular hole transport material in the hole transport layer of Aziz with a reasonable expectation of success.

(10) Response to Argument

Section VII.A.

Appellant argues on pg. 3 of the Brief that the combination of Aziz with Lee 1 and Lee 2 does not teach or suggest heating the device at or below the glass transition temperature of the organic layer both before and after formation of the second electrode and therefore does not

support a rejection under 35 U.S.C. 103(a). Section VII.B.2(c) presents more detailed arguments. The arguments will be addressed below.

Section VII.B.2(c)

Appellant notes on pg. 6 of the Brief that Aziz discloses heating the device below the glass transition temperature (T_g) *after* formation of the second electrode, but fails to teach heating at any temperature *before* forming the second electrode. However, Lee 1 and Lee 2 are used to teach heating before forming the second electrode.

It should be noted that both Lee 1 and Lee 2 teach three distinct heating steps: 1) baking below T_g before electrode deposition (hereinafter referred to as "baking" for the sake conciseness), 2) annealing above T_g before electrode deposition and after baking (hereinafter "pre-annealing") and 3) annealing above T_g after electrode deposition (hereinafter "post-annealing") (the term "the annealing steps" will be used to collectively refer to both the pre-annealing and the post-annealing). The baking step of Lee 1 and Lee 2 corresponds to the claimed heat treatment before forming the second electrode.

Appellant argues on pg. 6-7 that the teachings of Lee 1 and Lee 2, when properly considered as wholes, would motivate the skilled person to heat an emissive polymer *above* its T_g, thereby teaching away from heating the emissive polymer at or below its T_g before forming the second electrode as claimed. Appellant continues to argue on pg. 7 that Lee 1 and Lee 2 both disclose annealing the film above T_g after baking the film. However, the present claims do not exclude the use of additional heating treatments above T_g.

Appellant argues on pg. 7 that Lee 1 and Lee 2 both suggest a relationship between the baking step and the annealing steps and that a consequence of the baking step is the introduction of "pores [into the polymer film, the pores] left after evaporating the solvent by baking below T_g." Subsequent annealing above the T_g enhances the packing of the film because of the introduced pores. Appellant continues to argue that Lee 1 and Lee 2 would have suggested the use of a baking step below T_g and an annealing step above T_g in combination. However, Lee 1 teaches that pre-annealing or post-annealing can be performed (pg. 249, col. 2). Pre-annealing can improve stability of the emissive polymer and give off more bright light, but does not improve quantum efficiency (pg. 250, col. 1-2). Annealing causes the polymer chains to move

freely and enhances the packing of the polymer which have some free volume or pores left after evaporating the solvent by baking (pg. 249, col. 1-2). Lee 2 teaches that pre-annealing, post-annealing or post-annealing after pre-annealing can be performed, and that pre-annealing can eliminate the pores and enhance packing of the film in order to avoid electrical failure and defects (pg. 801, col. 2). Both Lee 1 and Lee 2 teach that the annealing steps would change the polymer morphology. See Lee 1 at pg. 249, col. 2 and Lee 2 at pg. 801, col. 2.

On the other hand, Aziz teaches an annealing step "below the melting temperature of the material forming the light emission region" and/or "below the glass transition temperature of the material having the lowest glass transition temperature of all the materials forming the organic light emitting device" after forming the second electrode [0085], and that "[t]he annealing temperature is preferably also selected to avoid any substantially structural changes of the organic light emitting devices as a result of the annealing" [0086]. Aziz would have reasonably suggested a post-annealing temperature that does not substantially change the structure of the film. The annealing steps of Lee 1 and Lee 2 changes the polymer morphology, which would create a substantial change of the structure. Aziz would have taught away from the use of the post-annealing step of Lee 1 and Lee 2. Thus, the combined teachings of Aziz, Lee 1 and Lee 2 would have reasonably suggested a spin coating step, a baking step below T_g, a pre-annealing step above T_g and a post-annealing step below T_g. The claims do not exclude an additional step of heating above T_g.

Appellant argues on pg. 7 that Examiner has taken the position that the baking step of Lee 1 and Lee 2 is separable from the annealing steps. Appellant continues to argues that Lee 1 and Lee 2, when properly considered in their entireties, would not motivate the skilled person to incorporate a baking step below the T_g without an additional anneal step above the T_g and that one would not be motivated to modify Aziz to include a baking step below the T_g without also performing subsequent annealing at a temperature above the T_g. After further consideration, Examiner agrees that the combination of references would have suggested at least one annealing step above T_g. The combined teachings of Aziz, Lee 1 and Lee 2 would have most reasonably suggested a baking step below T_g, a pre-annealing step above T_g and a post-annealing step below T_g. The claims do not exclude an additional step of heating above T_g.

Appellant argues on pg. 8-9 that annealing above T_g as taught in Lee 1 and Lee 2 satisfies the requirements set forth in Aziz of reducing the operating voltage by up to 40% and increases the quantum efficiency. Examiner takes the position that Aziz teaches the need to reduce the operating voltage of the device without compromising their quantum efficiency and/or no corresponding reduction in the quantum efficiency [0005]. Aziz also teaches the need for an increased brightness level at a given driving current [0009]. Lee 1 teaches that the pre-annealing results in the EL device giving off more bright light without failure under a high electric field without improvement of quantum efficiency (i.e., with no reduction in quantum efficiency) (pg. 250, col. 1). Thus, the pre-annealing step satisfies the requirements of Aziz. Additionally, both Lee 1 and Lee 2 teach that annealing is needed to enhance the packing of the polymer film. See Lee 1 at pg. 249, col. 2 and Lee 2 at pg. 801, col. 2. Lee 2 teaches the pre-annealing can eliminate the pores and enhance the packing of the film. Therefore, the pre-annealing alone was sufficient to achieve the purpose of Lee 1 and Lee 2.

Appellant argues on pg. 9 that Aziz can not be properly combined with Lee 1 and Lee 2 because Aziz teaches away from substantial structural change while Lee 1 and/or Lee 2 teaches that the baking step would introduce voids into the polymer film and that the annealing steps would change the polymer morphology. However, Aziz teaches an annealing step "below the melting temperature of the material forming the light emission region" and/or "below the glass transition temperature of the material having the lowest glass transition temperature of all the materials forming the organic light emitting device" after forming the second electrode [0085], and that "[t]he annealing temperature is preferably also selected to avoid any substantially structural changes of the organic light emitting devices as a result of the annealing" [0086]. Aziz would have reasonably suggested a post-annealing temperature that does not substantially change the structure of the film. The annealing steps of Lee 1 and Lee 2 changes the polymer morphology, which would create a substantial change of the structure. Aziz would have taught away from the use of the post-annealing step of Lee 1 and Lee 2. Thus, the combined teachings of Aziz, Lee 1 and Lee 2 would have reasonably suggested a baking step below T_g, a pre-annealing step above T_g and a post-annealing step below T_g. The claims do not exclude an additional step of heating above T_g.

Appellant argues on pg. 9 that the skilled person would not be motivated to combine Aziz with disclosures such as Lee 1 and Lee 2 which teach that altered morphology can be advantageous, much less to modify Aziz to include a baking step that was found to introduce voids into the polymer film and thereby increase the ability to change its morphology. Although Aziz teaches that layers comprising the light emission region can be prepared by forming the "materials into thin films by any suitable known or later developed method" and only explicitly exemplifies "vapor deposition and spin-coating techniques" [0075], Aziz is completely silent about the details of either vapor deposition or spin-coating techniques. One of ordinary skill in the art must look into the relevant art, such as Lee 1 and/or Lee 2, to use the spin coating method and to properly form the film using spin coating without deterioration to the device. The selection of something based on its known suitability for its intended use has been held to support a prima facie case of obviousness (MPEP 2144.07).

As to Appellant's arguments on pg. 9-10 directed to dependent claims 6-9, 12, 14-18 and 20-24 as being patentable due to their dependency to claims 1 and 19, the rejections of claims 1 and 19 are being maintained for the reasons discussed above. Applicants have not separately argued the patentability of the dependent claims. Thus, the rejections of claims 6-9, 12, 14-18 and 20-24 will also be maintained.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/James Lin/
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